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13. ABSTRACT Describes a method for evaluation of combat helmet physical and functional performance characteristics. Identifies supporting tests, facilities, and equipment required. Provides procedures for preoperational inspection, physical characteristics, safety, personnel training, sizing, fitting, compatibility with other equipment, maintainability, reliability, durability, human factors, troop acceptance, and value analysis.			

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U. S. ARMY TEST AND EVALUATION COMMAND
EXPANDED SERVICE TEST - SYSTEM TEST OPERATIONS PROCEDURES.

AMSTE-RP-702-109
Test Operations Procedure 10-3-025

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COMBAT HELMET

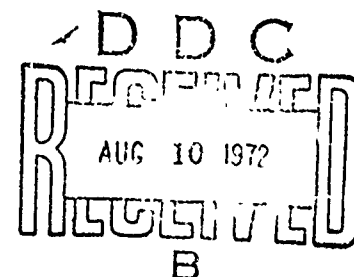
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SECTION I
GENERAL

1. Purpose and Scope.

a. This Test Operations Procedure (TOP) is published as a guide to be used in preparing a test plan to support an Expanded Service Test (EST) of a combat helmet. The procedures outline a series of subtests which, when completed, should produce data to support a judgment of the suitability of a type combat helmet for entry into the Army inventory.

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b. These procedures address preoperational inspection and physical characteristics, safety, training of test soldiers, sizing and fitting, compatibility of the helmet with other equipment, maintenance, reliability and durability, human factors engineering, and value analysis.

c. Ballistics protection is not a topic of these procedures.

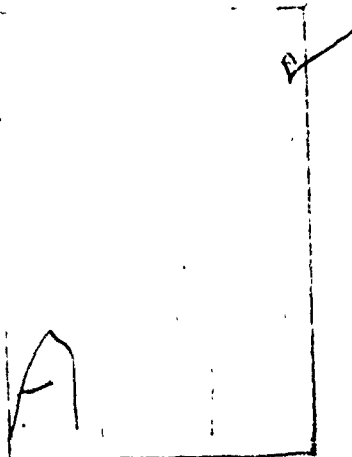
2. Background.

The Department of Army has approved a materiel needs requirement for a system of lightweight individual clothing and equipment. Supporting technical characteristics establish the limitations and standards of the items to be manufactured, tested, evaluated, and eventually approved or disapproved for the use of US Army troops. Following, or concurrent with technical testing, e.g. Engineer Design Tests, which will address such functions as ballistics protection, expanded service testing will be directed toward an evaluation of other functions and characteristics of the candidate item.

3. Equipment and Facilities.

a. Equipment.

- (1) Test item and accessories.
- (2) Control items as prescribed.
- (3) Linear and weight measuring equipment.
- (4) Appropriate crew served weapon units.
- (5) Infantry unit with TOE weapons and equipment.
- (6) Photographic equipment.
- (7) Safety and First Aid Equipment.
- (8) Tactical Vehicles - Air and Ground.
- (9) Body Armor.
- (10) Ammunition.



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- (11) Explosives.
- (12) Grenades.
- (13) Communications equipment.
- (14) Stopwatch.
- (15) Chemical Munitions.
- (16) Pyrotechnics.

b. Facilities.

- (1) Field Training Areas.
- (2) Ranges.
- (3) Airfield.
- (4) Confidence Course.
- (5) Classroom, storage area, and office space.
- (6) Bayonet and Grenade Assault Courses.

SECTION II
TEST PROCEDURES

4. Supporting Tests.

a. The procedures outlined in this TOP provide guidance to a test officer for the conduct of an expanded service test of a combat helmet. The tests are described in successive paragraphs but need not be conducted in the order of their listing. Some will be performed simultaneously or overlap. Specific, detailed procedures should be developed by a test officer in accordance with directives received and guidance offered by local commanders and advisors.

b. The data collected should be of sufficient quality and quantity to support valid conclusions. This objective may be constrained by

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limits in the quantities of test and control items available, a limited time frame to accomplish testing, or limitations of manpower, funds, and/or support facilities. The test officer should consult a statistician to establish the experimental design and to identify the best means of securing the most meaningful data within the limitations imposed. The consultation should determine the number of test personnel needed, the number of test and control items required by phase, and the optimum number of replications or repetitions required of a specific operation to produce statistically sound conclusions. Additional guidance may be found in MTP/TOP 3-1-002, Confidence Intervals and Sample Size.

c. The maintenance of a log book for entry, in chronological order, of pertinent remarks and observations, meteorological data, uniforms and equipment worn by the test soldiers, the time of day, and other applicable information will aid in the subsequent development of test data to support findings. The use of photographs and motion pictures is recommended.

d. Current doctrine prescribes that the helmet be worn with the chin straps fastened. However, experience has proven that helmets are habitually worn with the straps either unfastened or fastened in some position other than the authorized under-chin position. Particular attention should be directed to the times and circumstances of these deviations and an account recorded of any advantage or disadvantage, comfort, or relief experienced by test soldiers experimenting with ad hoc strap positions.

e. Common Service MTP/TOPs, the tests defined in Section III, and other published documents to be considered in formulating an expanded service test are listed below. Additional reference material may be found in the reference appendix.

<u>TEST SUBJECT TITLE</u>	<u>PUBLICATION NO.</u>
(1) Preoperational Inspection and Physical Characteristics (refer to para 5)	10-3-500
(2) Safety Irefer to para 5)	10-3-507
(3) Personnel Training (refer to para 7)	10-3-501

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- (4) Adequacy of Sizing and Fitting
(refer to para 8)
- (5) Compatibility With Other Equipment
(refer to para 9)
- (6) Maintenance Evaluation 10-3-504
(refer to para 10)
- (7) Durability (refer to para 11) 10-3-502
- (8) Human Factors Engineering 10-3-505
(refer to para 12)
- (9) Value Analysis
(refer to para 13)

5. Preoperational Inspection and Physical Characteristics.

a. Perform the applicable procedures directed in MTP/TOP 10-3-500, Preoperational Inspection and Physical Characteristics, to verify the completeness of the test helmet, to compare the physical characteristics of the helmet with those stated in materiel needs documents, and to determine that the test item is in serviceable condition and suitable for testing.

b. This phase of testing is of prime importance in that defects in manufacturing, damage incurred as a result of shipping or faulty handling, incomplete units or components, and variations from specified norms may be properly labeled as such and not reported as the result of subsequent testing.

c. Defects discovered as a result of this preliminary action should be labeled, photographed, and fully reported in after action reports. In some instances it may be necessary to obtain additional test items in an acceptable condition as replacements before proceeding with further testing.

6. Safety.

a. Perform the appropriate procedures of MTP/TOP 10-3-507, Safety, to determine the effectiveness of the helmet's safety features, and to confirm the safety of each test component.

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b. During this phase, the test officer must identify any restrictions imposed by the safety release, directives, or any local ground rules which might influence test results. An impact evaluation, along with a judgment of the test officer as to the degree safety restrictions influenced test results, should be documented and included in post-test reports.

7. Personnel Training.

a. Training as prescribed in the pertinent parts of MTP/TOP 10-3-501, Personnel Training, should be conducted to evaluate the training package (if available) which accompanied the test item, and to orient test participants with the test helmet, the conduct of the test, and individual responsibilities toward operational proficiency.

b. Sufficient pretest training should be accomplished to ensure that test personnel are equally familiar with the test and control helmets. It is important that the test item not be degraded because of its newness, or because the soldiers are unfamiliar with the item.

c. In the event instructional material or a test training package is furnished with the test helmet, an evaluation of its adequacy should be a prime function of this subtest. Information related to time required for acceptable orientation, completeness of the program of instruction, and recommendations for change or improvement should be recorded for incorporation into after-action evaluations and reports.

8. Adequacy of Sizing and Fitting.

a. Objectives.

This phase of testing should evaluate written fitting instructions received with the test helmet; determine if the helmet and its components have been produced in sufficient sizes to accommodate at least the 5th through 95th percentile values for body size; and determine if item will retain its fit characteristic.

b. Method.

(1) A representative number of soldiers, to include 5th and 95th percentile individuals, should be issued a standard issue helmet and a test helmet (The test item should be issued in strict accordance with written instructions accompanying the test item.) Extreme care

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should be taken to fit each soldier with a helmet as comfortable and as stable as possible within the tariff sizes furnished. Soldiers should be instructed to adjust all components of each helmet system to their satisfaction and to individually compare them. Any difficulty arising during the fitting should be recorded. Once the test officer feels that the soldiers are adjusted to the new test item's idiosyncracies, a timed exercise in donning and doffing should be conducted.

(2) Using the fit obtained in the above exercise, the test soldiers should attempt to don the helmets over the environmental cap (cap, insulating, helmet liner-helmet, cotton, nylon/oxford, OG 107). Should readjustments be required, time to readjust and difficulties encountered will be noted.

(3) Throughout the conduct of all subtests personnel should be alerted to observe, comment, and record evidence related to sizing and fitting.

(4) A portion of any questionnaire utilized should address sizing and fitting.

c. Data Required.

(1) The amount, type, completeness, and clarity of written instructions received with test helmets should be noted. The reaction of soldiers and instructors to the fitting instructions and pertinent questionnaire responses will assist documentation.

(2) The method used to fit soldiers and size issued to each.

(3) Observations and comments related to fit, comfort, stability, or other aspects of wearing the helmet.

(4) A record of any difficulty or inability to fit a soldier within the confines of sizes provided.

(5) The time required to fit and adjust each helmet, both test and control.

(6) A comparison of the relative comfort of the test helmet with control item.

(7) The relative adequacy of test and control helmets and their suspension systems to sustain the fit.

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d. Analytical Plan.

(1) A subjective analysis should be performed on data assembled from observations, comments, and opinions expressed through questionnaire answers.

(2) Performance comparisons of test and control items should be statistically analyzed to determine if any significant differences are apparent which make one system better than the other. Mean times of donning and doffing, and adjustments, are measurable areas.

(3) The narrative analytical plan should be supplemented with charts, pictures, movies, or graphs appropriate to the issue.

9. Compatibility With Other Equipment.

a. Objective.

To determine whether the test helmet allows the soldier sufficient freedom of movement to successfully accomplish his normal duties and activities while wearing, carrying, or using other equipment commensurate with his tasks.

b. Method.

A TOE Infantry unit, equipped with combat load, organic weapons, and test and control helmets should:

(1) Conduct motor marches over primary, secondary, and unimproved roads in a variety of vehicles, i.e. M-151, M-715, M-35A2, and M-561 trucks, and the M-151 APC. The exercises should permit test soldiers to experience like-type situations while alternately wearing test and control helmets. During one phase, troops should be subjected to an attack which forces them to dismount, deploy and maneuver against an enemy force; then to remount, and continue the march.

(2) Conduct foot marches during which soldiers should alternately wear the test helmet and the control items. In addition to changing helmets, participants should experiment with chin strap positioning and compare the relative comfort afforded as a result of the strap's movement.

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(3) Traverse confidence, bayonet, and grenade assault courses in timed exercises designed to compare the test with the control items and to check the compatibility of each with the soldiers' clothing, equipment, and tasks. A Clothing and Equipment Test Facility (CETF) located at Fort Benning allows the collection of performance measures as described in MTP/TOP 10-2-509, Combat Effectiveness Test Facility. Many of the procedures accomplished at Fort Benning, through instrumentation, may be modified for use at other locations with reduced instrumentation requirements.

(4) Conduct parachuting activities to include tower and HALO jumps with the parachutists wearing and carrying a variety of the special gear required for aerial delivery action. Appropriate procedures of MTP/TOP 7-3-511, Airdrop Operations - Personnel and Individual Equipment, will assist in planning such exercises.

(5) On-load and off-load a helicopter. On-loading should be conducted while the aircraft is on the ground with engine running and blades turning. Off-loading should require soldiers to jump 4-6 feet from a hovering aircraft. Soldiers should participate in each exercise enough times to get the feel of both helmets, test and control, under similar circumstances.

(6) Conduct crew-served weapons drills while alternating test and control helmet systems. The drills should be conducted with crew served weapons organic to the unit, direct support weapons, or candidate weapons nearing entry into the Army inventory.

(7) Conduct crew-served weapons field firing exercises designed to develop man-weapon compatibility statistics.

(8) Fire individual weapons (or instrumented ranges where possible).

(9) Participate in tactical exercises of 3-5 day duration. These field exercises should be conducted under simulated combat conditions and include the preparation of utilization or a base camp; day and night patrolling activities; approach march and an attack on an objective; and the preparation and occupation of a defensive position. During the exercises, the test soldiers should be subjected to a CB attack requiring decontamination of the helmet system. The helmet should be subjected to normal cleaning, washing, and camouflage, and it should be used as a wash basin if suited for such ancillary use. Additionally, donning and doffing exercises in conjunction with simulated CB attacks should include the wearing of the helmet with the M17A1 mask and the M6 hood and gloves.

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Decontamination should incorporate the appropriate procedures outlined in TM 3-220 for each type of material used in the helmet construction.

c. Data Required.

(1) Comments, observations, and other evidence describing the influence of the test helmet on:

(a) The mobility and job proficiency of soldiers performing assigned tasks.

(b) The proficiency of soldiers engaged in individual and crew served weapons drill and firing exercises.

(c) Interference of the helmet with weapons or equipment employment.

(d) The use of specialized gear such as that required for parachute training and delivery.

(e) The use of chemical-biological equipment and decontamination procedures.

(2) Times obtained in those exercises where the test helmet was alternated with the control item in comparison tests.

d. Analytical Plan.

(1) Comments, opinions expressed, and observations recorded should be subjectively analyzed and significant results documented.

(2) An appropriate statistical analysis of the measures of effectiveness should be conducted to determine any significant differences between test and control items or test item and criteria. This analysis should include:

(a) Mean times to complete obstacle, confidence, grenade, and bayonet courses, and CETF exercises.

(b) Mean times to complete crew served weapon drills and firing exercises.

(c) Results of statistics obtained from firing exercises.

10. Maintainability.

a. Apply pertinent procedures of MTP/TOP 10-3-504, Maintenance Evaluation, to determine if the maintenance directions listed in the instructions for use are adequate, and to compare the maintenance requirements of the test helmet with the control item and criteria expressed in materiel needs documents.

b. The maintenance evaluation of this test helmet should be conducted concurrently with other testing whenever possible. The normal maintenance performed while test participants engage in the variety of test situations should provide data comparable to that equated to the normal user environment.

11. Reliability and Durability.

a. The applicable procedures of MTP/TOP 10-3-502, Durability, should be performed to determine the degree to which the test helmet will successfully survive a projected service-life in a serviceable condition while performing its intended function.

b. MTP/TOP 10-3-502 has been prepared as a guide to assist in examining durability during the testing of general equipment. The broad contents are adaptable in part to any item under test. A careful review of all requirements documents, test directives, and pretest guidance should be accomplished to insure that the specific durability requirements are closely examined.

c. Upon completion of all tests each component of the tested helmet should be examined for serviceability. The number of serviceable items should be compared to the total number of items tested and a reliability judgment rendered. Reliability figures should be calculated at a 90-percent confidence level for each component. The overall durability and reliability of the tested helmet may be determined by an evaluation of critical component failures. (A component failure is defined as any weakness or discrepancy in a part which renders it unserviceable or less than functional.)

12. Human Factors Engineering and Troop Acceptance.

a. The applicable procedures of MTP/TOP 10-3-505, Human Factors Evaluation, should be accomplished to determine whether the test item

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meets the human factors requirements expressed in the materiel needs documents, is suited for service by human factors principles, and the degree to which the helmet meets with troop approval.

b. Throughout the conduct of all subtests data pertaining to soldier acceptance, degradation of performance, and compatibility of the test item with soldier skills, aptitudes, and limitations should be collected. Questionnaires, interviews, and observations of supervisory personnel are means of collecting such information. The subjective data thus collected should be quantified and then correlated with the objective data collected from the static test elements.

13. Value Analysis.

a. Objective.

To determine if the item being tested has any nonessential or costly parts or features which could be eliminated without adversely affecting its performance.

b. Method.

Concurrent with all testing, participating personnel should be alerted to the requirement, and briefed on methods of reporting any nice-to-have but superfluous features of the test item.

c. Data Required.

The comments and observations of test participants related to value analysis.

d. Analytical Plan.

A subjective analysis of data collected should be prepared and supported by pictures, charts, tables, or graphs as required.

Recommended changes to this publication should be forwarded to Commanding General, U.S. Army Test and Evaluation Command, AMSTE-ME Aberdeen Proving Ground, Maryland 21005. Technical information related to this publication may be obtained from the United States Army Infantry Board, STEBC-MO-M, Fort Benning, Georgia 31905. Additional copies of this document are available from the Defense Documentation Center, Cameron Station, Alexandria, Virginia 22314. This document is identified by the accession number (AD No) printed on the first page.

APPENDIX
REFERENCES

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14. TM 3-220, Chemical, Biological and Radiological (CBR) Decontamination, November 1967.
15. MIL-STD-1472A, Human Engineering Design Criteria for Military Systems, Equipment and Facilities.